

**REMARKS**

Claims 1-26, 28, and 29 are pending in this application. By this Amendment, the specification has been amended for clarity, and claims 22 and 24 have been amended. Applicant submits that the amendment to the specification is not new matter because ethylene oxide itself does not contain a cation exchange group, but rather homopolymers and copolymers derived from monomers such as ethylene oxides, etc. are polymerized to include cation exchange groups. However, for purposes of clarification alone, Applicant has amended the exemplary list for the Examiner's consideration. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Applicant gratefully acknowledges the Office Action's indication that claims 27 and 28 would be allowable if rewritten in independent form. However, Applicant submits that all pending claims are in condition for allowance.

**1. 35 U.S.C. §112**

The Office Action rejects claims 22 and 24 under 35 U.S.C. §112, second paragraph. Claims 22 and 24 have been amended to obviate the rejection. Withdrawal of the rejection is respectfully requested.

**2. 35 U.S.C. §102(b)**

**a. *Taft***

Claims 1-3, 6, 7, 9, 10, 14, 15, 18, and 21 are rejected under 35 U.S.C. §102(b) as being anticipated by *Taft, III et al* (U.S. Patent No. 6,630,265, hereinafter referred to as "*Taff*"). The rejection is respectfully traversed.

The Office Action states:

With respect to Claim 1, Taft discloses a nanocomposite electrolyte membrane for a fuel cell, comprising: a polymer based binder, an inorganic cation exchange material including clays and silicates, and a silica based binder (column 5 lines 15-17) in which the silicate nanoparticles are intercalated with the polymer through mechanical agitation (see example 1).

See page 3, lines 3-7 of the Office Action.

However, Applicant respectfully submit that *Taft* does not disclose or suggest intercalating a polymer through mechanical agitation. Rather, *Taft* discloses "mixing the membrane components in a solvent to minimize agglomeration" wherein Example 1 of *Taft* discloses that "the mixture was thoroughly homogenized through mechanical agitation for 5 minutes at 23° C." See col. 7, lines 36-38 and col. 7, line 61 through col. 8, line 4.

The Office Action further states that:

Applicant argues that the *Taft* reference does not disclose or suggest silicate particles being intercalated with the polymer of layers of the silicate nanoparticles being exfoliated. However, Examiner interprets this claim to recite that the silicate nanoparticles being intercalated with the polymer merely means that they are dispersed within one another and holds to the rejection of this claim under the *Taft* (US 6,630,265) reference.

See page 9, lines 5-10 of the Office Action (emphasis added).

However, intercalation is different from dispersion. First, as discussed in our Example 1 of pages 10 and 11 of the present specification, Applicant discloses that "a mixture of 0.1 g of the swelled montmorillonite nanoparticles in a Nafion solution containing 1 g of Nafion was vigorously stirred at about 80°C for about 70 hours to provide a slurry for forming a nanocomposite electrolyte membrane." Applicant submits that the 5 minute agitation of *Taft* at 23° C would be insufficient for providing intercalation.

Additionally, Applicant submits that "intercalation" has meaning within the art.

For example, in U.S. Patent No. 7,049,353, intercalation is defined as:

"The following definitions are provided to help clarify language used to understand embodiments and are not meant to narrow the regular dictionary meanings of the words used. "Layered material" means an inorganic material, such as a smectite clay mineral, that is in the form of a plurality of adjacent, bound layers. "Platelets" means individual layers of the layered material. "Intercalate" or "intercalated" means a layered material that includes one or more monomeric ester and/or monomeric ether molecules disposed between adjacent platelets of the layered material to increase the interlayer spacing between the adjacent platelets. "Intercalation" means a process for forming an intercalate. "Intercalant monomer" or "intercalant" means a molecule that is adsorbed between platelets of the layered material and complexes with the platelet surfaces to form an intercalate. "Intercalating carrier" means a carrier comprising water with or without an organic solvent used together with an intercalant monomer to form an intercalating composition capable of achieving intercalation of the layered material. "Exfoliate" or "exfoliated" means individual platelets of an intercalated layered material so that adjacent platelets of the intercalated layered material can be dispersed individually throughout a carrier material, such as water, a polymer, an alcohol or glycol, or other organic solvent. "Exfoliation" means a process for forming an exfoliate from an intercalate.

See U.S. Patent No. 7,049,353, col. 3, line 41 to col. 4, line 2 (emphasis added). See also U.S. Patent No. 6,812,272, for example.

Thus, *Taft* does not disclose or suggest intercalation but rather merely discloses mixing membrane components in a solvent at low temperatures for short time periods, which is different from the processes described in the specification for intercalation.

For at least the reasons set forth above, Applicant respectfully submits that claim 1 is allowable. Claims 2, 3, 6, 7, 9, 10, 14, 15, 18, and 21 depend from claim 1 and are allowable for at least the same reasons. Withdrawal of the rejection is respectfully requested.

b. *Blanton et al.*

Claims 26 and 29 are rejected under 35 U.S.C. §102(b) as being anticipated by *Blanton et al* (U.S. Patent No. 6,555,610, hereinafter referred to as "*Blanton*").

The rejection is respectfully traversed.

The Office Action states that:

With respect to Claim 26, *Blanton et al.* discloses a membrane consisting essentially of: a polymer having cation exchange groups (polyethylene oxide); silicate nanoparticles (smectite or montmorillonite clay) dispersed in the polymer (column 4 lines 44-50) and a cationic surfactant adsorbed within the silicate nanoparticles (column 7 lines 2-5). According to MPEP 2111.03, absent a clear indication of what the basic and novel characteristics actually are, "consisting essentially of" will be construed as equivalent to "comprising" (PPG, 156 F.3d at 1355, 48 USPQ2d).

With respect to Claim 29, *Blanton et al.* discloses a method of forming nanocomposite membrane comprising, mixing silicate nanoparticles with surfactant water and a polymer having cation exchange groups (column 7 lines 2-5); and drying the mixture to form a nanocomposite membrane (column 7 lines 46-48).

See pages 4 and 5 of the Office Action (emphasis added).

However, polyethylene oxide in and of itself does not contain cation exchange groups. Rather, as mentioned above and discussed in the specification, polyethylene oxide is used to form a homopolymer or copolymer which includes cation exchange groups. See pages 5 and 6 of the original specification.

Specifically, page 6, lines 6-30 specify cation exchange groups including homopolymers and copolymers derived from monomers of specific formulas and at least one monomer selected from the group, which includes ethylene oxide. See page 6, lines 16-20. However, *Blanton* fails to disclose or suggest polymers which include cation exchange groups and only discloses the use of polyethylene oxide (and polyvinyl pyrrolidone), which *Blanton* does not disclose as being cation

exchange group containing, as preferred polymers mixed with clay. See col. 4, lines 58-63, for example.

For at least the reasons set forth above, Applicant submits that claims 26 and 29 are allowable. Withdrawal of the rejection is respectfully requested.

3. 35 U.S.C. §103(a)

a. *Taft* in view of *Blanton*

Claims 4, 5, 16, and 17 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Taft* in view of *Blanton*. This rejection is respectfully traversed. *Blanton* fail to disclose or suggest all the features of at least claim 1. Therefore, Applicant submits that claims 4, 5, 16, and 17 are also allowable for at least the same reasons. Withdrawal of the rejection is respectfully requested.

b. *Taft* in view of *Grot et al*

Claims 8, 19, and 20 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Taft* in view of *Grot et al* (U.S. Patent No. 5,919,583, hereinafter referred to as "Grot"). The rejection is respectfully traversed.

For at least the reasons set forth above, Applicant respectfully submit that *Taft* fails to disclose or suggest all the features of claim 1 from which claims 8, 19, and 20 depend. *Grot* fails to cure the deficiencies of *Taft*. While *Grot* discloses a process for forming a membrane of polymer having cation exchange groups and dispersing inorganic filler in the membrane by *in situ* precipitation, *Grot* fails to disclose or suggest, as recited in claim 1, at least the feature of silicate nanoparticles being

intercalated with a polymer having cation exchange groups or layers of disilicate nanoparticles being exfoliated. Rather, inorganic filler is dispersed within the membrane in Grot, which for the reasons mentioned above, differs from intercalation.  
See col. 3, lines 12-20, for example.

Claims 8, 19, and 20 depend from claim 1, therefore Applicant submits that because claim 1 is allowable for at least the reasons set forth above, claims 8, 19, and 20 are also allowable. Withdrawal of the rejection is respectfully requested.

c. *Taft in view of Yen et al*

Claims 11-13 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Taft* in view of *Yen et al* (U.S. Patent No. 5,795,496, hereinafter referred to as "Yen"). The rejection is respectfully traversed.

Applicant submits that for at least the reasons set forth above, *Taft* fails to disclose or suggest all the features of claim 1 from which claims 11-13 depend. *Yen* fails to cure the deficiencies of *Taft*. *Taft* discloses proton conducting membranes based on a sulfonic acid-containing polymer and fails to disclose or suggest at least the features mentioned above with respect to claim 1.

Claims 11-13 depend from claim 1, which as discussed above is allowable. Withdrawal of the rejection is respectfully requested.

4. Conclusion

Applicant invites the Examiner to contact Applicant's representative at the telephone number listed below if any issues remain in this matter, or if a discussion regarding any portion of the application is desired by the Examiner.

In the event that this paper is not timely filed within the currently set shortened statutory period, Applicant respectfully petitions for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

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